rapid dilatation and version. The use of elastic bags may lead to accident as in Jardine's case.[1] In inducing labor for contracted pelvis and placenta prævia, a De Ribes bag was introduced as a dilator. The bag burst and the fluid which it contained rapidly separated the placenta, causing sudden and severe hemorrhage.

The later weeks of pregnancy give opportunity for a most useful study of the pregnant patient, by which the possibilities for spontaneous labor may be ascertained, abnormalities detected, complications foreseen, and such measures taken as to conduct the woman and her child safely through the perils of parturition. A physician loses a great opportunity not only to enhance the welfare of his patient, but to increase his own knowledge and skill if he neglects this period of gestation.

SOME APPLICATIONS OF STATIC ELECTRICITY IN DERMATOLOGY.[2]

By HENRY G. PIFFARD, M.D., LL.D.,
NEW YORK,
PROFESSOR (EMERITUS) OF DERMATOLOGY, NEW YORK UNIVERSITY.

STATIC electricity as a therapeutic aid was first employed in America by Benjamin Franklin, about one hundred and fifty years ago. He placed patients on an insulated stool, charged them from a simple frictional machine, and drew sparks from various parts of the body. He also charged large Leyden jars, and discharged them through the patient. With this technic he benefited temporarily or permanently a few cases of paralysis. Others, both in America and abroad, employed static electricity to a limited degree, extending somewhat its range of application.

The voltaic cell, however, came into notice as a therapeutic agent and gained many adherents, in consequence of the simplicity of its operation, and static electricity was relegated to the background. The earlier types of cell—zinc-platinum (Grove) and zinc-carbon (Bunsen), both employing porous cups and strong acids—were inconvenient, insomuch as it was necessary to dismantle and clean them immediately after use. The Smee (zinc-platinized silver) and the Grenet (zinc-carbon), each requiring but a single fluid, rapidly displaced the Grove and Bunsen types, and shared the popularity accorded the Daniel cell and its modifications. An efficient apparatus, however, adapted to general use, required a battery of from twenty to forty cells, capable of generating a current of from twenty to eighty volts, according to the type of cell employed. The current from such a battery flows continuously in one direction.

The studies of Faraday later led to the introduction of a new type of electrical apparatus which is frequently called after his name. This consisted essentially of one or more voltaic cells, a soft iron core and hammer, and two concentric coils of copper wire, insulated from each other; the outer coil having a longer and finer wire than the inner. The circuit from the cells traversed the inner coil, and being broken by the interrupter, generated or induced a current of higher voltage in the outer coil. Instead of using voltaic cells to generate the primary current, the constant direct current from a dynamo may be conveniently employed as I have formerly shown (*New York Medical Journal*, July 11, 1891). Instead of the magnetic interrupter, the initial current may be broken by some mechanical device, as a toothed wheel revolved at a rapid rate by an electro-motor. If Leyden jars or preferably flat condensers be added to the installation and properly connected up as in the Ruhmkorff, a current of still higher tension is obtained. If again, instead of the apparatus being actuated as above, the initial current be taken from a dynamo giving an alternating current, the magnet, and hammer, and the toothed wheel may be dispensed with, and the apparatus be both simplified and rendered more energetic. Some ten years ago Tesla developed this phase to a higher degree than any of his predecessors. In other words, he produced an apparatus that yielded a current characterized by an exceedingly high frequency of alternation, and of a voltage or tension that was a surprise to the world. Concerning the current he wrote as follows: "We operate a coil either from a specially constructed alternator capable of giving many thousands of reversals of current per second; or by disruptively discharging a condenser through the primary, we set up a vibration in the secondary circuit of a frequency of many hundred thousand or millions per second, if we so desire; and in using either of these means we enter a field as yet unexplored."[1]

This field has now been quite thoroughly explored from a physiological and therapeutic standpoint by d'Arsonval, Apostoli, and others. Briefly the effects of this H. F. (high frequency) and H. P. (high potential) current on the human system are an increased utilization of oxygen, an increased elimination of carbonic acid, and an increase in the general metabolism. In other words, it acts as a tonic, or, as I would prefer to term it, an energizer. This statement has been borne out by both clinical experience and scientific experiment. The local effects of this current I shall not allude to here, as those who are sufficiently interested can delve into the ample literature of the subject.

The distinguishing features of the Tesla current are the extreme rapidity of the reversals or oscillations of the current, so great indeed as to defy measurement and almost to defy computation, and accompanying the high frequency the potential is raised to a point and that seems incredible. This type of current, however, was already known to the world through the labors of Dr. William J. Morton, who first drew attention to the "static induced" current in various affections, and thus established a new era in electro-static therapeutics.[2]

Some have endeavored to detract from the credit due Morton in respect to the use of this current, claiming that generations ago its existence had been demonstrated. Be that as it may, it was certainly Morton who first used it systematically in the treatment of disease, and made public the fruits of his experience. Thousands of people had seen steam issuing from the spout of the tea-kettle, but the world waited for a Watts to harness this powerful agency and adapt it to so many useful purposes.

The physiological effects of the ordinary "faradic machine" consist in little more than localized muscular contractions, accompanied with more or less pain, but so far as I have been able to observe, the current possesses but little constitutional influence.[3] With the static induced current, on the other hand, one may obtain simultaneous tetanization of a large number of muscles with little or no pain, and constitutional effects similar to those obtained with the H. F. and H. P. currents derived from the D'Arsonval apparatus.

Static electricity and high-frequency currents have for some time been successfully employed in the treatment of certain cutaneous affections, more perhaps in

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[1] Glasgow Medical Journal, January, 1898.

[2] Read at a meeting of the New York Dermatological Society, September 25, 1900.

[1] "Experiments with Alternating Currents of High Potential and High Frequency." New York, 1892.

[2] MEDICAL RECORD, April 2, 1881.

[3] I am not unmindful of the claims made in behalf of Beard's "general faradization."

Europe than in America; and I am enabled by personal experience to corroborate in great measure the claims that have been made in their behalf.

Desiring to use in dermatologic practice high-frequency currents of even higher potential than those of the static induced current, my thoughts turned to the use of the Tesla oscillator, which would involve the installation of an alternating dynamo, condensers, and an up-step transformer. Tesla, however, states, as already quoted, that his H. F. and H. P. currents may be obtained by "disruptively discharging a condenser through the primary of a coil." All that would be necessary, therefore, would be to connect the coarse inner wire of a suitable coil in series with the static induced current.

Mentioning my requirements to Dr. Harry F. Waite, of this city, he constructed an up-step transformer that has yielded the most satisfactory results. The transformer itself consists of an inner coarse wire, the terminals of which are connected to the outer coatings of the Leyden jars of a large static machine. A long coil of fine wire surrounds the inner coil, and the whole is very thoroughly insulated by a modification of the Tesla insulation. The outer case measures seven by seven by twelve and one-half inches. From one side project the terminals of the primary, and from each end the terminals of the secondary coil. The Leyden jars are twelve inches in height and four in diameter, and the inner and outer coatings extend to within two inches of the top. If the static machine be now brought into action, with the sliding poles separated so as to give a spark gap of two or three inches, electric streams issue from the terminals of the secondary coil. If the hand be brought to within about two inches of either terminal, a spark appears to leap forth and pierce the skin. The impact, however, is absolutely painless, in fact barely perceptible to the senses, in this respect quite unlike other static sparks. If fifty or a hundred of these sparks be directed to one point, the skin becomes slightly reddened, and the blush remains for several hours or even a day or two. The same phenomena appear whichever terminal is approached. If one terminal is grasped firmly with the hand there are absolutely no sensation and no muscular contraction, and the same is true even if both poles be grasped, one in either hand. It would seem almost beyond belief that an alternating current, with its millions of oscillations per second and its immeasurable voltage, also (by calculation) in the millions, should thus traverse the body without affecting it to a degree appreciable to the senses. Yet such is the case. Whether this current produces any physiological, constitutional, or metabolic effects, I have not determined, as my observations thus far have been confined to a study of its local effects on cutaneous lesions.

The most convenient way of applying the current is by means of special electrodes. One of these is a metallic point with insulated handle, and the other a closed glass tube about five inches long and three-fourths of an inch in diameter, with an inner coating of tin foil. This also has a long, well-insulated handle. The electrodes should be connected to the terminal of the secondary coil by means of a well-insulated cord, and when in use kept free from any possible conductor, as otherwise a portion of the current will be dissipated. From the character of the current it may be conveniently termed a high-tension oscillating current, or briefly H. T. O. As the term "secondary," however, has been applied to the static induced current, the one here described may, with equal propriety, be termed tertiary.

My use of this tertiary current has been chiefly in connection with chronic infiltrated eczema, rosacea, acne, localized pruritus, pityriasis capitis, the localized so-called "eczema seborrhoicum" and seborrhœa oleosum, in all of which resolution of the lesions has been accomplished more rapidly than by any means previously at my command.

Addendum. It has already been stated that if the terminals of the secondary coil of the transformer be grasped, one in either hand, there is absolutely no sensation or apparent muscular action. If, however, one hand be removed, say half an inch from one of the terminals, muscular contractions immediately ensue. This led me to intercalate Ranney's device for regulating the spark gap, and by means of it, generalized contractions can be controlled with the utmost nicety; ranging from those barely perceptible up to those that are hardly bearable. If asked concerning this current, "*Cui bono?*" my only present reply must be "*Quien sabe.*"

As a further experiment I placed the Ranney regulator in series with the primary coil of the transformer, and obtained a current apparently more energetic than when it was in series with the secondary, but both sparks and muscular contractions were more painful, and the cutaneous reaction was greater. It reminds me, in fact, of the effects obtained with a high-frequency machine in which an alternating dynamo is the source of energy; in other words, of the Tesla current. I have not as yet made any therapeutic use of this modification of the current, but would not be surprised if it should prove useful in some of the profounder lesions of the skin.

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OBSERVATIONS ON THE SURGERY OF THE GALL TRACTS.[1]

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The surgery of the gall tracts may be said to have begun about twenty years ago. In 1879, Lawson Tait did his first cholecystostomy for removal of gall stones. This marks the opening of this field to the operations of the surgeon. Its development has been slow when compared with other departments of abdominal surgery. The complicated apparatus for storing and discharging the bile, together with much that was obscure as to its properties and uses, gave rise to many complicated problems in diagnosis and operative procedure, for solution by the surgeon. These difficulties have made progress slow and hesitating. These questions have engaged the attention of a multitude of workers all over the world and not only among surgeons. Their solution has been contributed to largely by the work of the physician, the physiologist, and the bacteriologist. Chemistry and pathology have lent their aid. The complete solution of any of them cannot yet be said to be an accomplished fact. A very great deal of work still remains to be done. The subject still remains a live one. As its investigation has been pushed along by a multitude of isolated workers, so it must be carried to something like finality in the same way.

Each year gives an added importance to the biliary apparatus as a factor in disease, as we understand it. Next to the appendix and the uterine appendages, it is the avenue by which serious disease most often enters the abdominal cavity.

Disease of this part mimics many other troubles. Many dyspeptic symptoms, nausea, vomiting, gastric pain, and discomfort are often traceable to this cause.

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[1] Read before the Oregon State Medical Society, June 26, 1900.

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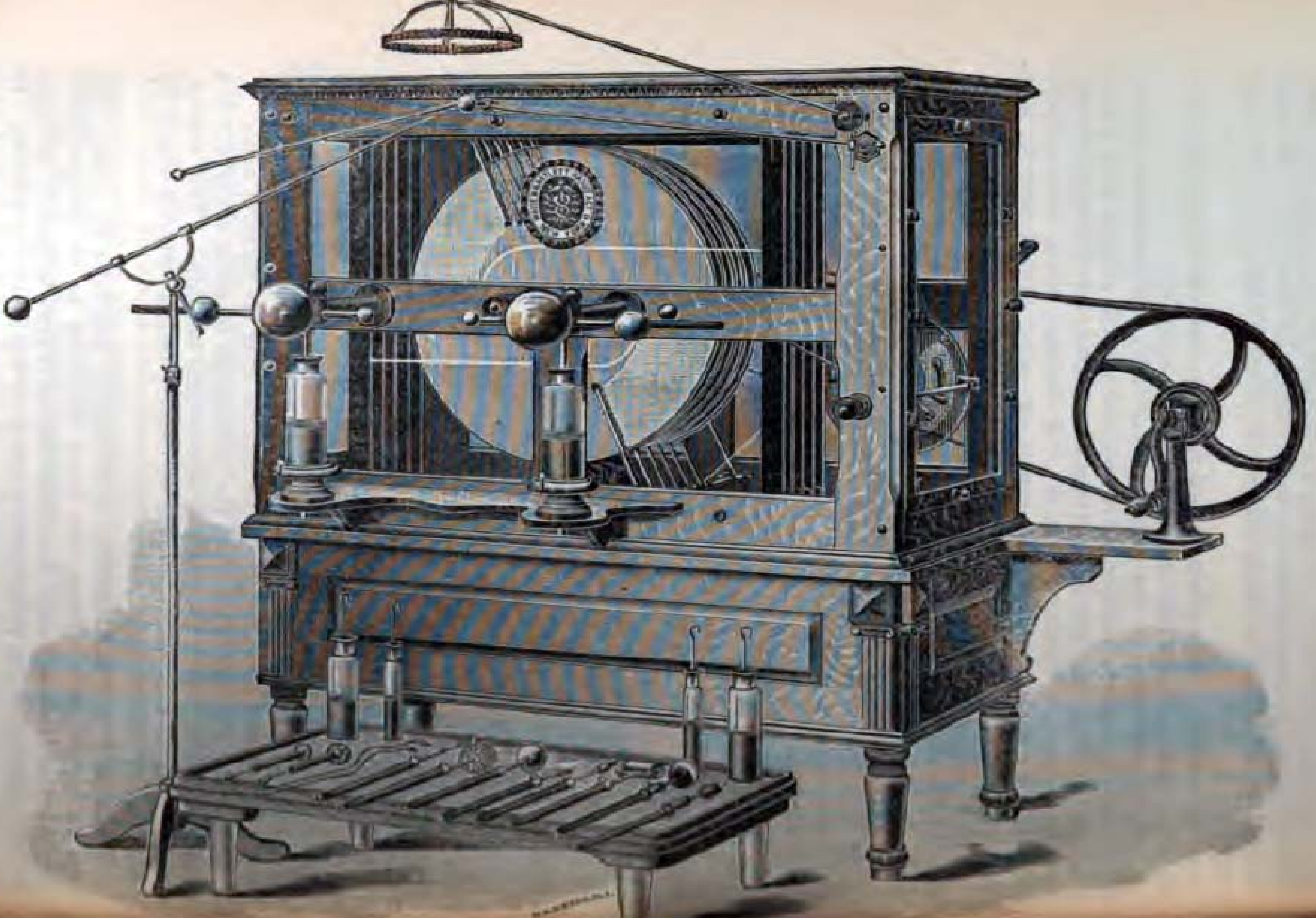

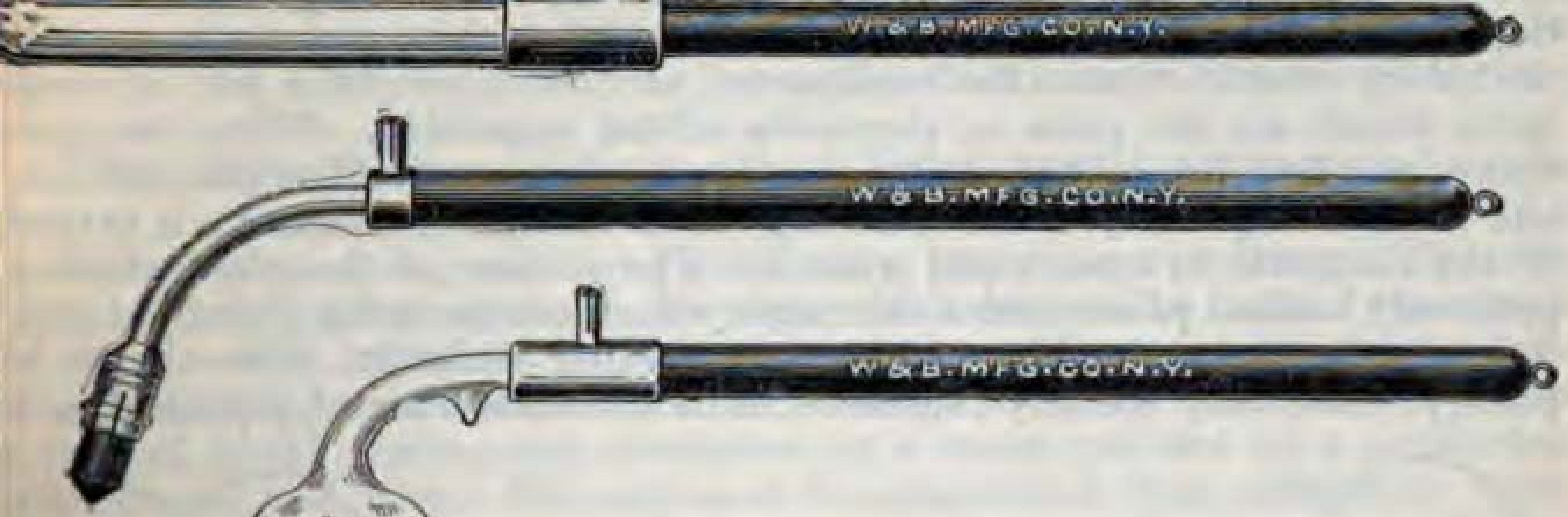
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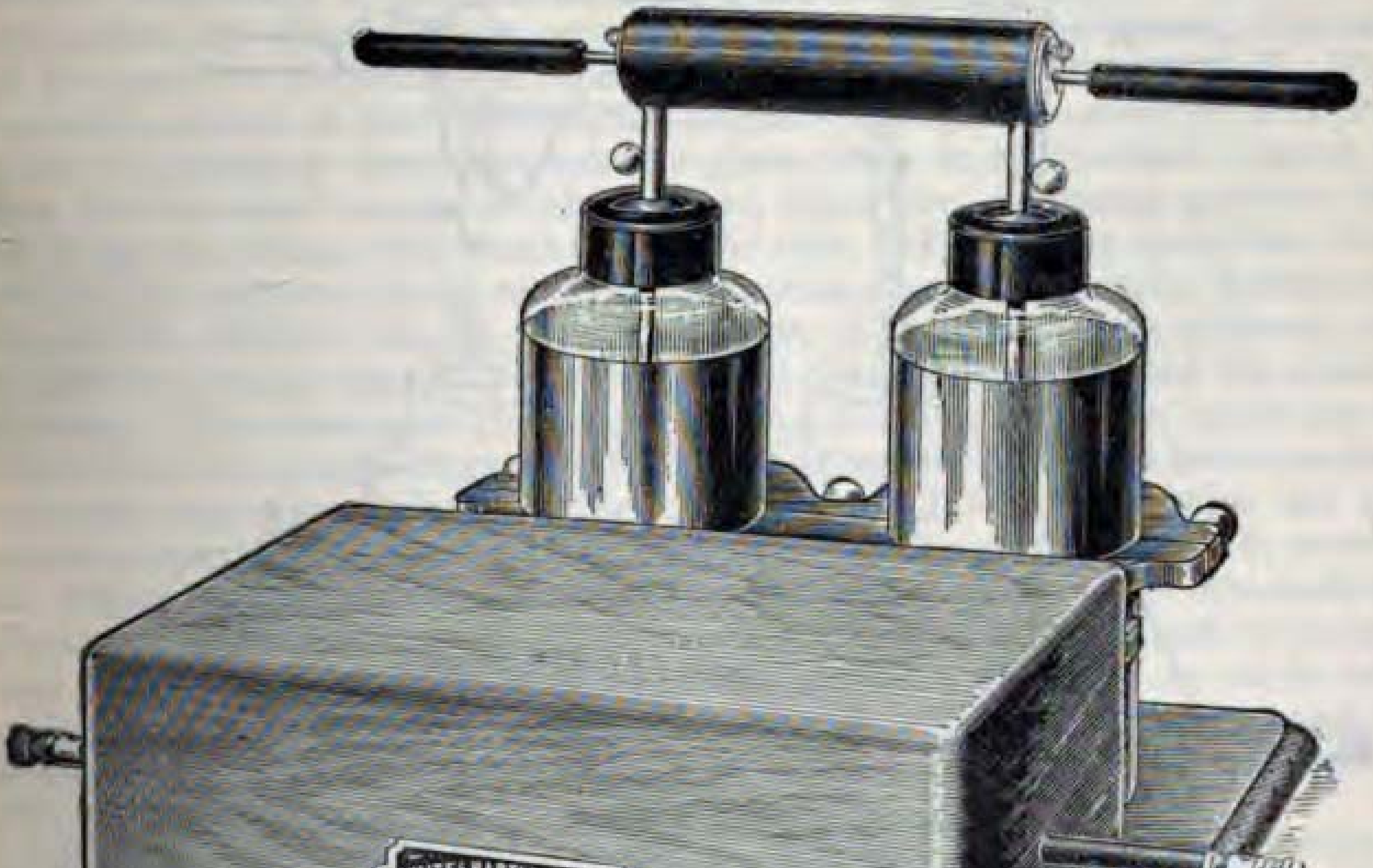

The Piffard Hyperstatic Transformer. (See diagram on next page.)

By connecting the transformer with a static machine the current undergoes a complete change, rendering its application painless even when applied to the most sensitive organs. As the current is of higher voltage than that of the static induced, the spark from one pole only is, as a rule, used, employing either a metal or carbon point, or else the glass tube lined with tin-foil (see diagrams at top of page). The effect of the hyperstatic spark on eczema and acne and in some cases of local pruritus has been extremely gratifying. In various forms of neuralgias, where irritation is wanted, any resisting medium interposed between the high-tension spark and the skin (such as covering the lesion with oil) will produce increased pain and irritation. One is able, therefore, by regulating the spark-gap between the jars, and using oil or not, as may be required, to obtain either an absolutely painless and almost fugitive effect, or, on the contrary, produce a very marked cutaneous reaction.

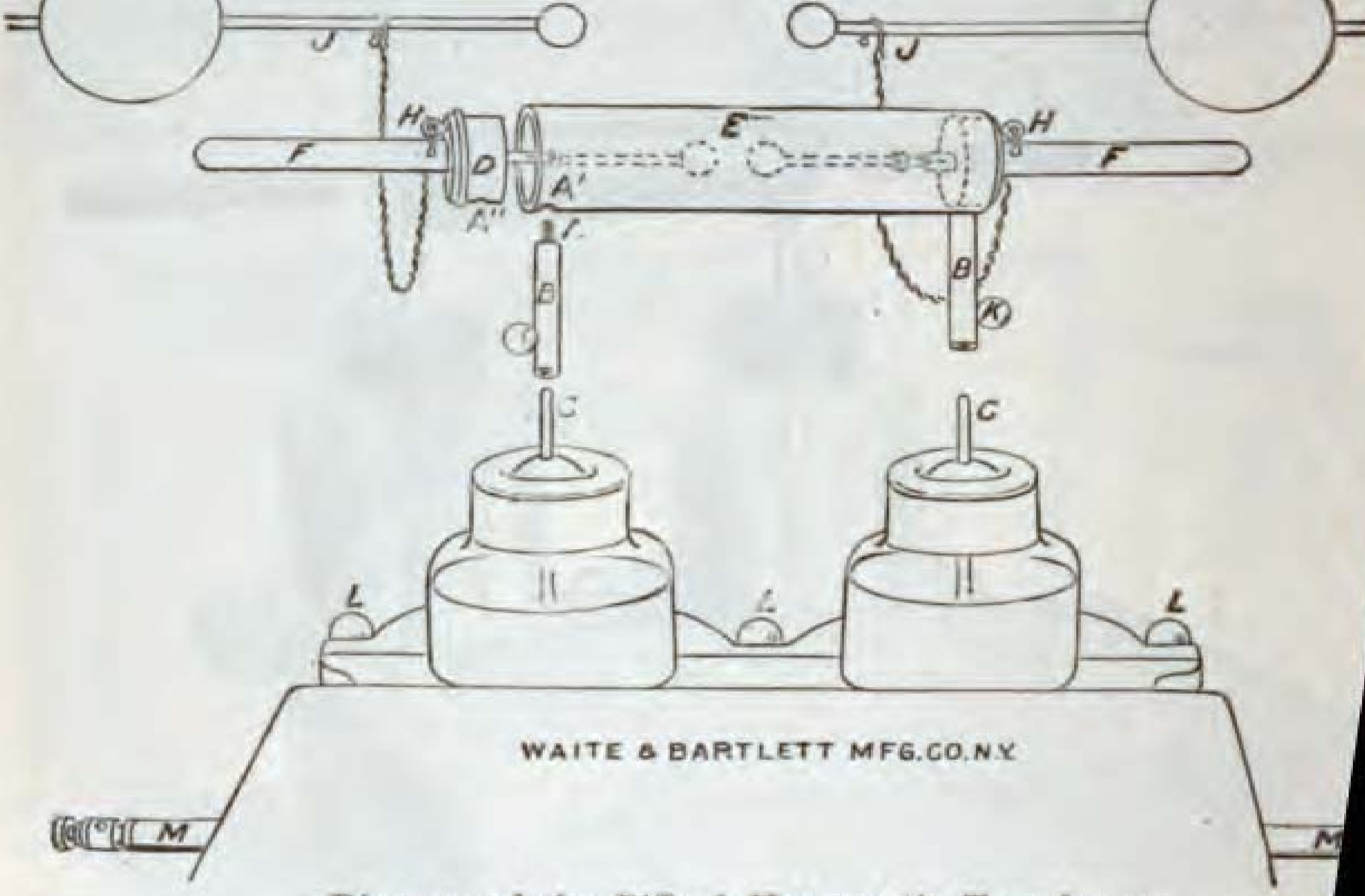

Diagram of the Piffard Hyperstatic Transformer.

J, *J*, Poles of static machine. *F*, Muffler for concealing spark and suppressing sound. *F*, *F*, controllers. *H*, *H*, Connectors with static. *D*, *D*, Removable ends of *E*. A'', Screw-hole. A', Scre *A*, Screw for A'' and A'. *B*, *B*, Arms for connecting *C* and *C*. *K*, *K*. Screws for tightening *L*, *L*, *L*, Screws for holding jars. *M*, *M*, For cords and electrodes. Directions: Connect the poles static machine with the muffler at *H*, *H*, this by the tubes with the projecting arm of the jars (*C*, regulate the strength of the discharge by the spark-controllers.

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HIGH-FREQUENCY CURRENTS.*

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If an electric current alternates or oscillates at a rate of a million times or more per second, it may with propriety be termed a "high-frequency" current. Such a current was introduced into practical medicine by Dr. William J. Morton in 1881.† It enjoyed a certain measure of vogue among those who employed static electricity in the treatment of disease, but its use was somewhat curtailed by the subsequent introduction by Dr. Morton of what is known as the "wave" current. This appeared to possess a wider field of usefulness than the earlier current to which the name Static or Franklinic induced current had been applied.

The brilliant experiments of Tesla with high power, high-frequency currents, induced D'Arsonval of Paris to study them carefully with a view to their utilization for therapeutic purposes. The result was the introduction of his high-frequency apparatus, the currents from which have been shown to produce very remarkable and very desirable results. It is to the currents from this apparatus with its various subsidiary appliances that the term "High-frequency" should be confined and is confined by all European authors.

I urge this, as high-frequency currents can be produced in various ways, but the currents themselves differ materially in character and can hardly be expected to produce exactly the same effects.

Three years ago I introduced still another high-frequency current, to which I gave the name "hyperstatic," in order to indicate its origin, and also to prevent its being confounded with the high-frequency current of D'Arsonval.‡

In order to make the matter clear I will indicate the manner in which these several currents are produced. To obtain the Morton "Static-induced" current you attach the leyden jars in the usual manner to a static machine. Then connect the patient to the outer armatures of the jars. Bring the sliding poles into contact and start the machine. Then separate the poles a short distance (say an eighth of an inch). The patient will now experience a slight sensation. If the spark-gap between the poles be increased to a quarter of an inch, distinct muscular contractions will take place, and if the gap be further increased the limit of the patient's endurance will soon be reached.

The D'Arsonval apparatus consists essentially of the following parts: (1) A good high-tension spark coil rated at eight or ten inches; (2) an efficient interrupter in the primary circuit; (3) Leyden jars or some other form of condenser of suitable capacity and (4) a solenoid. In other words, the simple addition of a solenoid to any *x*-ray outfit.

If the reader wishes to understand fully the D'Arsonval current let him connect the Leyden jars or other condenser to a static machine or coil. If now he takes a piece of wire and coils it helically so as to convert it into a solenoid, and attaches it to the outer coats of the jars with the electrodes attached to the same points and holds one in each hand, he will experience no sensation, but he must not deceive himself with the idea that there is "nothing doing," for if he will bring his hands close together, say within a quarter of an inch of each other, he will be promptly convinced to the contrary. This current which traverses the patient without giving rise to any special sensation is D'Arsonval's high-frequency current, and the only current to which, under this name, the European literature of the last ten years applies. It is only obtained when the patient is in a circuit *in shunt* to a suitable conductor connecting the external armatures of the condensers. It will be noted that there is *no spark gap* in the circuit of which the patient forms a part. The fact that a strong current passes through the body when in shunt to the solenoid may at first appear a matter of surprise, but it is due to the heavy impedance developed in the solenoid by the self-induction of the several coils of the solenoid on each other. In France an induction coil is universally employed in generating the D'Arsonval high-frequency current, probably because they have excellent coils in France, while their static machines are mere toys compared with those commonly used in this country. There is, however, a distinct difference between the high-frequency current from a coil and one from a good (American) static machine. The latter gives a current of higher voltage, but lower amperage.

D'Arsonval uses his high-frequency current direct from the solenoid, or in connection with two important subsidiary appliances. One of these is his condenser couch,§ which appears to me to be of but limited usefulness as compared with his large solenoid. This latter is about thirty inches in diameter and five or six feet high, large enough, in fact, to surround the patient without being in contact with him at any point. The terminals of the large solenoid are connected to those of the small solenoid, and the passing current induces a corresponding current in the body of the patient within the coil. Physiological experiments by D'Arsonval and others have shown that the current induced by the large solenoid notably increases the respiratory exchanges, the excretion of the urinary solids (including urea, uric, and phosphoric acids), the toxicity of the urine, and the radiation of heat from the body. In other words, there is a decided increase in the general metabolism, or as a French writer expresses it: *"Une suractivité plus grande des combustions organiques."*

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*Read at a meeting of the Medical Society of the County of New York, September 28, 1903.

†Recent experiments by Dr. Manders (*Medical Electrology and Radiology*, July, 1903) appear to throw some doubt on this statement. According to this writer, the Morton arrangement gives rise to an interrupted, unidirectional current, and not to an alternating or oscillating one.

‡My hyperstatic transformer was at first made with the coarse wire inside the fine or secondary winding, the two being separated by modified form of the Tesla insulation. It was soon found better to reverse the arrangement, and to place the coarse winding outside the finer and using glass for dielectric. D'Arsonval also, in 1900, introduced his "Nouvelle bobine bipolaire," which involves a similar arrangement except that he depends on air instead of glass as the dielectric.

§A condenser couch can be readily arranged by taking a cheap examining table and laying a sheet of metal or wire gauze on the middle part. On this is spread two or three layers of cotton felt, over this again the thin mattresses or cushions that come with the table. The total expense need not exceed twenty-five dollars. Mr. Chisholm Williams has used the condenser couch with apparent benefit in the treatment of pulmonary tuberculosis.

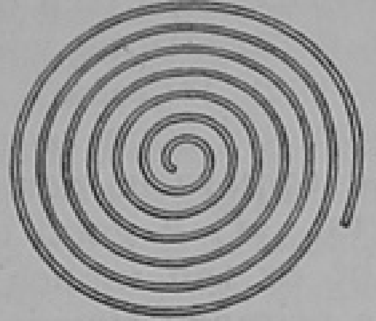

FIG. 1.—Spiral.

When we consider the large number of affections now recognized as depending on or accompanied by defective or retarded catabolism, the physiological data above given will readily indicate the therapeutic measures that may with confidence be pursued.

In 1893 Oudin of Paris connected his "resonator" to the D'Arsonval small solenoid, and in this way materially increased the potential of the current. Its chief use is in the local treatment of diseases of the skin.

My own hyperstatic transformer (MEDICAL RECORD, October 20, 1900) gives a high-frequency current, but it differs from the D'Arsonval current by its higher voltage. I have used this current only for the local modification of lesions and for its derivative effects. Whether it possesses any constitutional action or is capable of in any way modifying metabolism, I do not know. When I have desired to influence nutrition or to stimulate metabolism by means of high-tension currents I have availed myself either of static electricity pure and simple, or have used the D'Arsonval current.

The fact that an insensible current (*i.e.* one that cannot be felt) produces such sensible effects has as yet received no adequate explanation. The fact, however, remains, and a very ready and convenient means of demonstrating it, is to put an ordinary 16 c. p. 110 volt lamp in series with the human body, and passing the current derived from the small D'Arsonval solenoid. With a current of, say, six amperes traversing the primary of an eight-inch coil the filament of the lamp will immediately become of a bright cherry red, and without causing the slightest sensation in the person through whom the current is passing. This means a current of between two or three hundred miliamperes. If a direct current of equal strength were passing, the electrodes would cause an unbearable burning pain, while if an alternating current of low frequency (a few hundred alternations per second) were used, there would be intense tetanization of the muscles.*

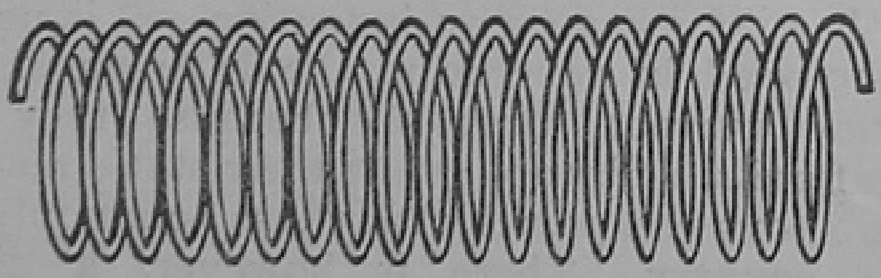

FIG. 2.—Solenoid.

Having used the D'Arsonval methods to a considerable extent, and having become thoroughly satisfied as to their potency in local lesions and their great value in improving the general metabolism, it yet seemed that some slight improvement might be made in the electrical technique, still preserving the essential D'Arsonval feature—that is, placing the patient in shunt to the current passing through the small solenoid. To this end I substituted a spiral† for a helix, and after many experiments with spirals of copper, brass, aluminum, iron, and steel finally found one that gave me results superior to those obtained with the D'Arsonval helix—the superiority being due to the fact that the self-induction and impedance was greater with the spiral than with the helix, and the shunt current consequently stronger.

The spiral that I have found most satisfactory is seven inches in diameter and nine inches and a half in height, including the base. When used with the static machine, place the largest jars in position and connect the terminals of the spiral with the outer coatings of the jars, with the electrode cords connected to the same points. The subsequent technique is that of D'Arsonval, which, briefly stated, consists in (1) applying both electrodes (metallic preferred) to the patient: (2) connecting one indifferent electrode (metallic) to the patient and bring a vacuum tube‡ near or in contact with the part that we desire to modify locally; (3) connecting one pole to D'Arsonval condenser-couch, the other pole being brought into contact with some part of the patient's body; (4) connecting the two poles with the terminals of D'Arsonval large solenoid or cage.

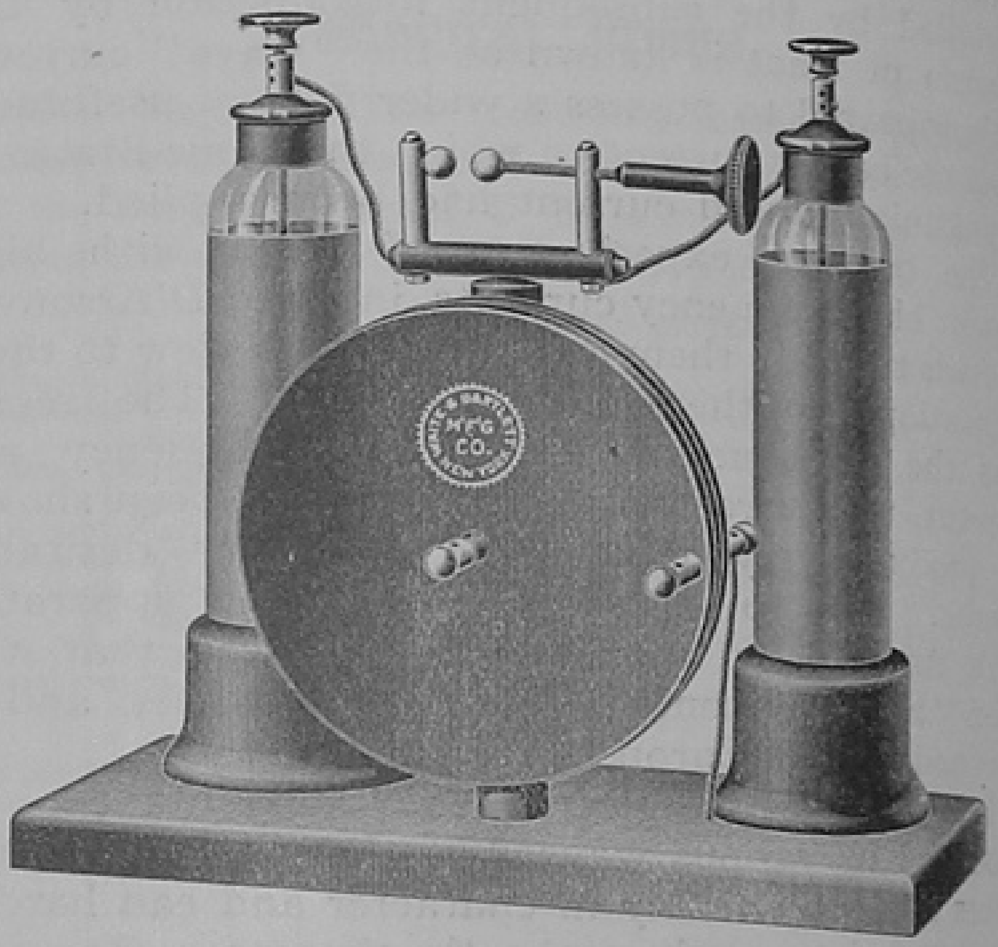

FIG. 3.—The author's high-frequency spiral for use with an *x*-ray coil.

If the spiral is to be used in connection with an *x*-ray coil *medium-sized* jars are mounted on the same base with the spiral, the terminals of which are already connected with the outer coatings of the jars. (Fig. 3.) The inner coatings of the jars are then connected to the terminals of the secondary coil, and the apparatus is brought into action with such spark-gap between the secondaries as may be found necessary. If two identical spirals are used one with a coil and the other with a static machine, the resulting shunt currents will not be identical—the former having the higher amperage and lower voltage.

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*The remarkable difference between the effects of low tension direct, and high-tension high-frequency alternating currents is well exemplified in the transmission of ocean messages. If a low-tension current is used, as from a large battery or dynamo, a metallic conductor traversing the sea must be employed. A high-frequency current, however, will flash the message over the ocean without the need of intermediate wires.

†A spiral is defined by the Standard Dictionary as follows: "Any plane curve formed by a point that moves around a fixed center and continually increases its distance from it." This is shown in Fig. 1. The solenoid or helicoidal employed by D'Arsonval is of the form shown in Fig. 2.

‡The use of vacuum tubes in connection with the therapeutic application of high-frequency currents is a purely American development, and the credit for their introduction belongs, I believe, to Dr. F. F. Strong of Boston. They are but little used or known in France or Germany, but have gained some favor in England.

The large solenoid of D'Arsonval is open at the top, but in the one I have had made for my own use the wire is continued in the form of a horizontal spiral, forming in this way a top to the cage. (Fig. 4.) It increases the auto-induction and adds to the efficiency of the apparatus. If a current of six or eight amperes be passed through the primary of the *x*-ray coil, the patient within the cage will experience but little sensation, although a powerful current is circulating through him. This will be readily demonstrated if he will hold the outer terminal of an Edison 16 c.p. 110 volt lamp between his finger and thumb, and touch the inner or central terminal to one of the upper wires of the cage. The carbon filament immediately becomes of a bright red. The spark-gap between the terminals of secondary of the coil need not exceed one-half of an inch. If longer than this the lamp will short circuit inside, or, as sometimes happens, the lamp filament will instantly flash to a full brilliance and then break.

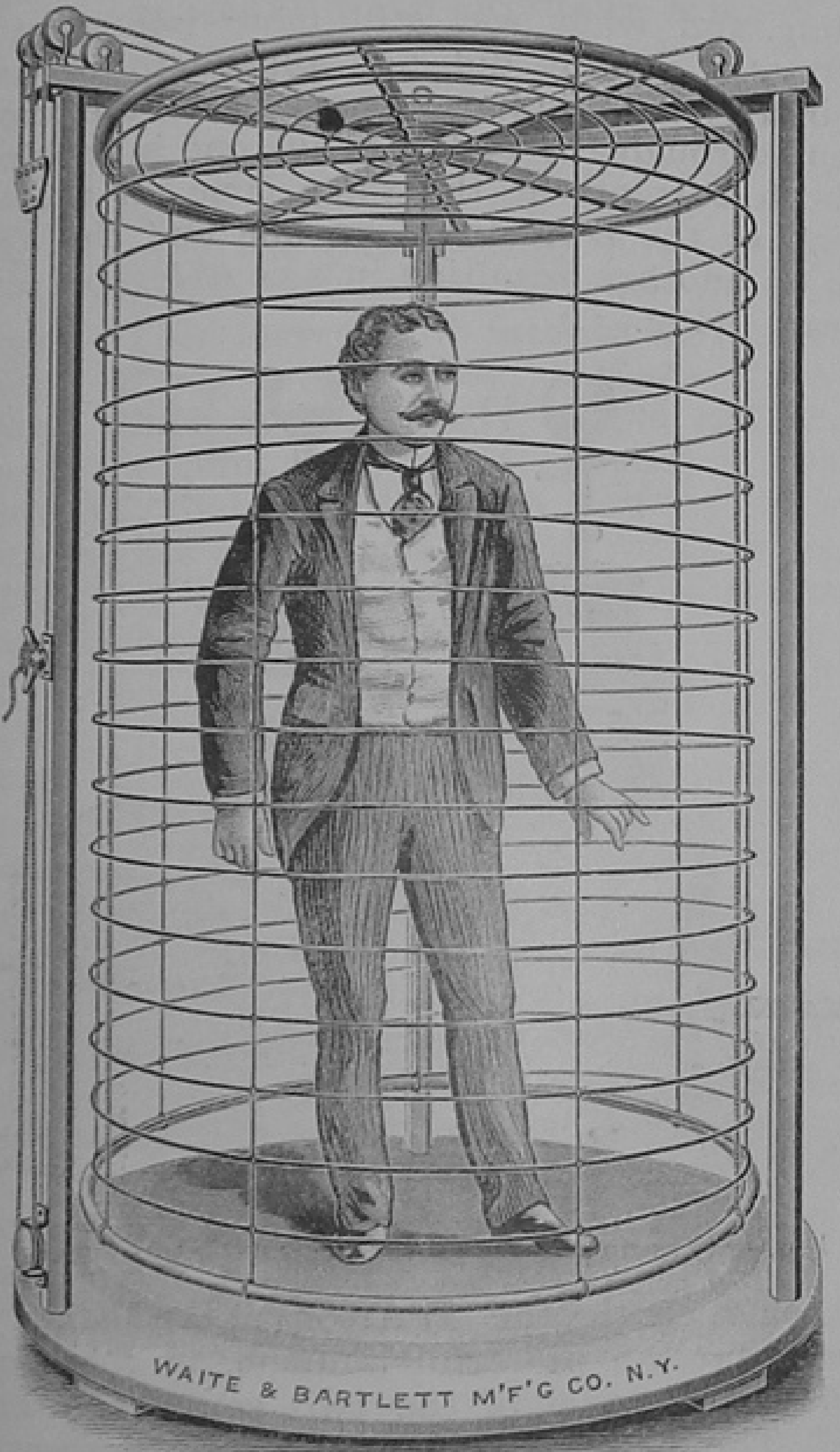
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FIG. 4.—The author's resonator or combined spiral and solenoid.

If, instead of connecting as above, one pole of the small solenoid or the author's small spiral be connected with the central terminal of the large flat spiral forming the roof of the cage, and the other pole to the point where the spiral joins the large solenoid, the induction effects are intensified as the arrangement now constitutes a large Resonator with the patient inside of it, instead of outside as with the Oudin. A still more intense effect is obtained if the small solenoid or spiral be omitted, and the outer and inner ends of the top spiral be connected directly to the outer armatures of the condenser (leyden jars). With the latter arrangement a longer spark-gap can be used. If connecting cords and electrodes are connected with any of the turns of the large coil, a regular D'Arsonval current with its secondary applications may be administered to one or more patients outside the solenoid, whether there is one within it or not; and this with but little apparent diminution of the intensity of the induced current within the cage.

I have not clinically used the large D'Arsonval solenoid in connection with a high-frequency current derived from a static machine, as my office arrangements will not conveniently permit of this combination. Experimentally it works in a satisfactory manner.

The very manifest difference between the wave-current of Morton and the high-frequency current of D'Arsonval immediately suggests the query as to the relative merits of the two in respect to their influence on metabolism. Clinical experience abundantly establishes the fact that both currents administered with care and judgment are capable of improving the various functional activities, including the respiratory, the thermogenic, and those relating to the conversion of ingesta into ejecta, be the same solid, fluid, or gaseous. The results of physiological experiment have shown the same in respect to the D'Arsonval currents, but I do not find that static electricity has been subjected to the same careful tests. Quite recently, however, some very careful and painstaking experiments with static electricity by MM. Maitre and Florence of Montpellier (*Archives d'Électricité Médicale*, April, 1903) have demonstrated that so far as the urinary secretion is concerned, the effects are similar in character but less in degree than those observed by D'Arsonval and others in connection with high-frequency currents. The machine employed consisted of two plates, capable of giving a spark of ten inches. It is to be regretted that the experimenters did not employ a more efficient apparatus. If this had been done it is quite possible that the metabolic results would have equalled, and perhaps surpassed, those obtained with the D'Arsonval system.*

It is now three years since I introduced the Hyperstatic Transformer for the local treatment of certain cutaneous lesions, and so far as I can learn the apparatus has given satisfaction to those who have used it. Some, however, I find do not appear to understand fully its capabilities or how to use it to

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*One of the earliest static machines constructed in America for therapeutic purposes was copied, I believe, from one imported from France, and it is not a little surprising that the French have been so backward in the further development of this apparatus. The current advertisement of a somewhat prominent French manufacturer offers a "*Machine Statique a Grand Débit*," which consists of two pairs of plates twenty-two inches in diameter! A toy like this would not be seen in an American office, where it would be difficult to find a static machine with fewer than eight pairs of plates of thirty inches diameter. Static machines of the Wimshurst type are the ones commonly used in Europe, and in this type each pair of plates requires a separate belt. If a large number of plates are mounted it is almost impossible to secure uniform rapidity of rotation, which greatly impairs the efficiency of the machine. In this country the Wimshurst is not manufactured for therapeutic purposes, but the prevailing types are the Holtz and the Toepler-Holtz. The latter is self-exciting and proves attractive to some, on that account, as well as by reason of the lower price at which it can be manufactured, but the writer's experience with it is far from being as satisfactory as with the Holtz machine, which requires an independent exciter. If a Holtz and a Toepler-Holtz have equal areas of revolving surface, the output of current will be greater from the Holtz; when in action the Holtz machine will not change polarity, which the Toepler-Holtz is liable to do, especially when under a heavy load, when using the wave current or a high-resistance *x*-ray tube.

the best advantage. To these I offer the following suggestions:

Having connected the transformer to the static machine (with poles in contact), turn on the power, and when the plates are revolving at about 300 or 350 times a minute, separate the poles about an inch. If the hand be brought near one of the terminals of the transformer, it will be met by a diffuse electric spray (*effluve* of the French). The same will occur when the hand approaches the other terminal, but it will be noticed that the spray is more intense at one of the terminals than at the other, and it will be found that the stronger spray will be opposite the positive pole of the static machine. I usually connect the electrode with this terminal. If a very mild effect is desired the other terminal of the transformer is left free. If a stronger effect is desired the inactive terminal is grounded, and if still more action is required this terminal is connected with some part of the patient's person. The strength of the current may be further modified by using a longer or shorter spark-gap. After studying the effect of the spray the electrode should be brought nearer the skin, and when sufficiently near, bright sparks will shoot forth to be replaced by a multitude of fine sparks when the electrode is brought in direct contact with the skin. The best spray effect and also the strongest sparks are obtained when using an electrode with a metal point. The most generally useful electrodes, however, are glass vacuum tubes. I use a dozen or more of these, of shapes adapted to the particular requirements of the case. Some are of low and others are of comparatively high vacuum.

The transformer may be used with an *x*-ray coil by connecting it to the terminals of the secondary wire of the coil and adjusting the spark-gap of the coil so that the length of the spark shall be one-half inch or less. As the current delivered by the coil differs from that of the static machine (being of higher amperage and lower voltage), the current from the transformer will be somewhat modified. The spray will be shorter, more compact, and finer; while from the vacuum tubes the sparks are much finer and more numerous. On the whole, I find the current from the transformer connected with the static machine more effective than when connected with the coil. If the experiments are conducted in a darkened room the luminous effects are very striking.

As I have endeavored to make clear, the functions of the hyperstatic and the D'Arsonval currents are quite different and distinct—the former being chiefly useful for local applications while the latter is capable of distinctly influencing the general system.

Nearly thirty years ago the writer became fully satisfied that in the majority of cases of chronic eczema there co-existed a condition of the system characterized by defective elimination of catabolic products, and he so expressed himself as fully as the facts then appeared to warrant.*

From that time to the present I have found no good reason to question soundness of the views then put forth, although they have not been generally accepted by dermatologists, many of whom are inclined to attribute the phenomena that accompany eczema to a local pathogeny.

If we rely on drugs to facilitate the elimination of these "*materies morbi*," or elements of autointoxication, we have at command diuretics, cathartics, diaphoretics, alkalies, and substances belonging to the salicylic group, but none of these has in my hands yielded results as satisfactory as may be obtained from high tension electricity, whether through the Morton wave or the D'Arsonval high-frequency currents.

When I have desired to obtain both the constitutional and local effects of high-tension electricity, I have until recently employed the wave or the D'Arsonval followed or preceded by the hyperstatic. This in many instances was tedious and time-consuming.

It then occurred to me to put binding-posts on the outside of the hyperstatic case and connect them with the terminals of the primary coil, leaving all other connections as before. If a patient be now introduced into this primary circuit he will receive the pure D'Arsonval current, and a 16 c. p. lamp placed in series will become incandescent. I could not obtain any evidence that the primary circuit was modified by the presence of the secondary winding, and what was still more important the hyperstatic current did not appear to be at all impaired by the simultaneous passage of the primary current through the body. Thus one is enabled to use both currents at the same time on the same subject, or the D'Arsonval on one and the hyperstatic on another, resulting in a considerable saving of time. (Fig. 5.)

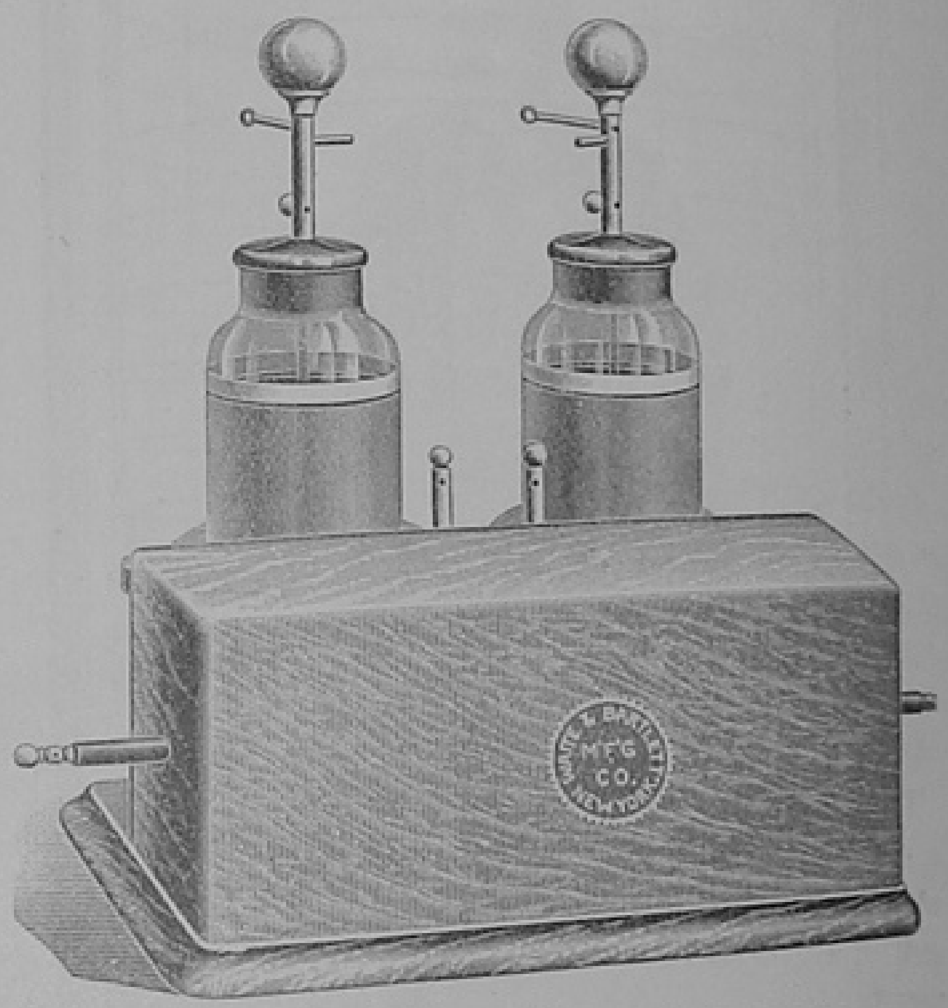

FIG. 5.—The author's improved hyperstatic transformer.

Although both the D'Arsonval and the wave currents exert a powerful influence on metabolism, the *modus operandi* of the two can hardly be the same. The first is a high-frequency current, the second is not. In the first the spark-gap will rarely exceed an inch, and in the second a gap of eight or ten inches is frequently employed. In the first there may be absolutely no sensation while the current is passing—in the second there is a vibratory sensation and the hair stands out from the scalp. After the passage of the D'Arsonval current for ten or fifteen minutes there may be but little change in the feelings of the patient—after the wave current there is generally a feeling of exhilaration and an apparent increase of energy. What changes then occur in the body during the passages of these currents, and in what way are their beneficial effects brought about? To these questions no certain answer can be given. In default of such, it seems reasonable to suppose that the wave current acts through a sort of molecular vibration or cellular massage, while the D'Arsonval may act through the development of heat in the tissues. A current that is capable of bringing the lamp filament to incandescence must of necessity develop more or less heat when traversing bodies that offer a similar high resistance to its passage.

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*"An Elementary Treatise on Diseases of the Skin," Macmillan & Co., London and New York, 1876.

The hasty sketch I have here given of the high-frequency currents is intended simply to attract attention to therapeutic agencies that I consider of high importance, and to encourage further research as to their general utility. The reader who desires to obtain a thorough working knowledge of the D'Arsonval current is earnestly advised to read Denoyés' "Les Courants de Haute Frequence," Paris, 1902; the chapter on "Hochfrequenzströme" (70 pages) contained in Freund's "Grundriss der gesammten Radiotherapie," Berlin, 1903; or Chisholm Williams' "High-frequency Currents in the Treatment of Some Diseases," London, 1903.

256 West Fifty-seventh Street.

TWO NEW METHODS OF DETERMINING THE DIGESTIVE ACTIVITY OF GASTRIC JUICE.[*]

By HENRY WALD BETTMANN, M.D.,
AND
J. HENRY SCHROEDER, M.D.,
CINCINNATI, O.

Up to within recent years little attention was paid by clinicians to the digestive activity of gastric juice. During the past decade, however, a number of articles have appeared dealing with this subject. This increase of interest is due to two causes: First, several new methods have been devised which are seemingly simple and accurate enough for clinical purposes; second, it has been discovered that the digestive activity of gastric juice does not always run parallel with the secretion of HCl; or, in other words, that the quantity of pepsin secreted is often independent of the quantity of HCl, and is subject to independent fluctuations.

Some of the older methods of estimating pepsin are accurate, but all are too complicated for clinical purposes.[†] Only two methods have been used extensively for clinical purposes, those of Mette and Hammerschlag, and all recent work has been done with one of these methods.

The method of Mette, as originally published, is as follows:[‡] "Fluid eggwhite is sucked up into a fine glass tube of 1 to 2 mm. lumen, and coagulated therein at a definite temperature (95° C.). The tube is then cut into small pieces, which are placed in 1 or 2 c.c. of the fluid to be investigated. The whole is kept in the thermostat at 37° C. to 38° C., and requires no further watching. Solution of the proteid occurs at the ends of the small glass tubes. After the termination of a certain period the length of the pieces of tube and that of the undigested remains of the proteid columns are measured off with the aid of a mm. scale and a microscope of low magnifying power. The difference gives the length of the digested proteid cylinders in mms. and fractions of a mm. This method leaves nothing to be desired so far as convenience of application and clearness with exactness of results are concerned. Test experiments specially carried out (Dr. Ssamojloff) have convinced us that the digestion of the proteid columns—at least within the first ten hours (employing the fluids which we have to deal with)—is directly proportionate to the length of the period. This was the case even when the fluid possessed its highest digesting power. These experiments did away with the very natural mistrust that the solution of the proteids may proceed at varying rates at different depths of the tubes, dependent on more or less stagnation of the digestive products within the lumen. It may, therefore be accepted that the length in mm. of eggwhite dissolved by the several juices in a certain time gives us an exact relative measure of the digestive power of the fluid. In the researches of Borissow carried out upon this question in the laboratory of Professor Tarchanoff, the relation which lies at the basis of the connection between the length of the digested column of eggwhite and the pepsin contents of the fluid under investigation came out with perfect clearness. The following is the rule which expresses it, viz., *The quantity of pepsin in the compared fluids is proportionate to the square of the rapidity of digestion*, *i. e.* to the square of the column (expressed in mm.) which the juices are capable of digesting in the same period of time. An example in figures will make this clear. If one of the fluids digests a column of 2 mm. of proteid, and the other a column of 3 mm., the relative quantity of pepsin in each is not expressed by the figures 2 and 3 respectively, but by the squares of these numbers, *i. e.* by 4 and 9. This rule has, of course, been deduced from comparisons made with numerous artificial solutions of pepsin exactly prepared. Moreover, the result which Dr. Borissow arrived at independently had already been discovered before him by Schütz from polarimetric observation of the amounts of peptone formed during the digestion of eggwhite. This correspondence in the data furnished by different methods affords strong assurance of the correctness of the rule. . . .

"We have still to add that the diameter of the tubes even within wide limits is without importance, and that the white of the hen's egg is of sufficiently constant composition to be employed as a test object for the purpose."

The method of Hammerschlag is carried out as follows: A c. 1 per cent. solution of egg albumen is prepared in the following way: 3.0 g. of albumen ovi sicc. is rubbed up with lukewarm water in a mortar, and then water is added to make the total quantity 150 to 180 c.c. This solution is filtered and officinal HCl is added until the solution contains 3 to 4 per cent. *free* HCl (as tested by titrating with $\frac{n}{10}$ KOH with dimethylamidoazobenzol as indicator). Ten c.c. of this acidified solution is now mixed with 5 c.c. of the gastric juice to be tested and another 10 c.c. is mixed with 5 c.c. of distilled water to serve as a control test. These mixtures are placed in two Esbach tubes, which they exactly fill up to the mark U, and are placed in the thermostat at body temperature for one hour. After one hour they are removed, and Esbach reagent is poured into the tubes up to the mark R. The tubes are inverted several times and then let stand twenty-four hours at ordinary room temperature. The sediment shows the amount of albumen present; in the control tube the original amount of albumen is shown in the other tube the albumen which has escaped digestion is shown. Thus the proportion of albumen digestion is easily estimated. Hammerschlag says that normal gastric juice digests 80 to 95 per cent. of the albumen in one hour.

Both methods have been used by a number of observers during the past ten years. The necessity for further and more critical work is shown by the variety of the conclusions reached. It is generally conceded that, for clinical purposes,

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[*] Paper read at the sixth annual meeting of the American Gastroenterological Society at Washington.

[†] A history of these methods is given by Schorlemmer and by Van Valzah-Nisbet.

[‡] This description is copied verbatim from Thompson's translation from Pawlow, "The Work of the Digestive Glands."

Radium as a Therapeutic Agent.

The discovery of radium may almost be said to mark an epoch in the history of science. The limit of its potentiality is as yet not nearly known, but the knowledge already gained of its properties clearly distinguish this mineral as in a measure standing apart; and it has been asserted that radium will open up a new field of scientific investigation, perhaps even lead to the isolation of a new group of elements. At the meeting of the New York Academy of Sciences, held recently, radium and the phenomena of radioactivity displayed by the mineral were considered, and a comparison was made between its powers and those of ultraviolet and Röntgen rays. George F. Kunz read a paper on the action of the Röntgen rays, ultraviolet rays, and radium on mineral substances, in one of the lecture rooms of the Natural History Museum. Mr. Kunz also touched briefly on the probable uses of radium in medicine. He said in part: "The invention of Goerl, which has been perfected under the name of the Piffard lamp in the United States by Dr. Henry G. Piffard of New York, is an instrument of great utility, as he has proved it a valuable medical adjunct. This brings to mind a possibility of the utmost importance. There is the possibility that fluorescent substances can be injected into the veins, intestines, etc., or it might be taken in powders or in solution in food, and thus a nearer location effected in organs desired to be examined. The entire tissue structure could then be examined, as well as the bony structure is at present by the Röntgen rays, under the ultraviolet rays." These, however, are but forecasts of what may happen. Some practical work has been done by means of radium. Mr. Mackenzie Davidson of London and Professor Gussenbauer of Vienna have had very successful results in the treatment of rodent cancer by the application of the rays from radium. Mr. Frederick Soddy of University College, London, has suggested a method of applying the rays from radium and thorium in the treatment of consumption. Mr. John Macintyre, surgeon for diseases of the throat and nose, Glasgow Royal Infirmary, contributed an article to the *British Medical Journal* of July 25, in which the therapeutic effects of the salts of radium—so far as is yet known—are well described. He thinks that the study of radium is evidently going to throw a considerable amount of light upon questions hitherto obscure in the region of physics, and it is not altogether improbable that the same thing may be said of it in medicine. According to Mr. Macintyre, three kinds of rays have been already distinguished: (*a*) Infinitely small positively charged atoms of matter flying at great speed, which can be measured, and the result seen by the bombardment on zinc sulphide screens; (*b*) rays which seemingly correspond to the cathodic rays in a Crookes's tube, and also described by Leonard as passing through an aluminum window in the same, and (*c*) rays which evidently correspond to the *x*-rays. The author then gives an account of some cases of lupus and rodent ulcer which yielded to treatment by the salts of radium, and concludes as follows: "A considerable time must yet elapse ere any opinion can be offered about the true value of radium compounds in the treatment of such cases. Even if its therapeutic value be thoroughly established, there will remain the questions of the time taken to produce the desired effect, the kind of cicatrix or covering which forms, and, last, but not least, to what extent they are likely to compete with the *x*-rays, high frequency, or other forces."

Radium, as a therapeutic remedy, is on its trial. There is the possibility, perhaps almost the likelihood, that it may eventually become of inestimable value in medicine, but at present sufficient is not known of its properties to pass a decided opinion. It is in the potential stage, but may emerge now at any time into an actual medical remedy of surpassing merit.

The Checking of Tuberculosis in New York.

Under the heading "The White Plague in New York," the *New York Evening Post*, October 17, gives an excellent sketch of the conditions with regard to consumption which prevail in the city, as well as a history of the disease, the measures which have been put into force to check its spread, and offers suggestions as to the best means of conducting a successful crusade against its inroads. So much has been written and said concerning consumption within the past few years, that it may seem somewhat supererogatory to again bring up the matter. On the principle, however, that "Continual dropping will wear away a stone," so may a persistent ventilation of the subject arouse the apathy of the general public with respect to the menace of tuberculosis. In the past ten years the deaths from various forms of tuberculosis in the Boroughs of Manhattan and The Bronx, have, it is said, averaged about six thousand annually, the great majority being due to pulmonary tuberculosis. This statement alone should be sufficient to excite the alarm of the citizens of New York and to arouse them to resolute action with a view to altering the present condition of affairs. The article in the *Evening Post* expains the indifference of the public as due to the fact that for generations people have been taught to believe that consumption was hereditary, and, when once contracted, incurable; that a certain large portion of each community had always been afflicted with this scourge and always would be; that those who were predestined to contract it would do so, and there wasn't much use in doing anything to prevent it.

Whatever may be the reasons for the disregard with which the ordinary individual regards consumption, one thing would seem to be certain, that if any headway is to be made against the spread of the disease, strict preventive measures must be taken, and that if the inhabitants of a city do not know enough to protect themselves they must be protected against themselves. In the first instance, every effort should be put forth to educate the public as to the nature and best methods of treatment of tuberculosis. At the same time the municipalities of large cities would do well to take immediate steps in the direction of preventive measures.

With perhaps some reservations, the language of the writer in the *Evening Post* in describing the methods most fitting to the situation, meets the circumstances of the case. He writes as follows: "In conducting a campaign against this destroyer of human life in a great city like New York two things are necessary for success. First, the education of the people in regard to the true nature of tuberculosis. Teach the masses that it is not a loathsome, secret, incurable disease reflecting disgrace or discredit upon the individual or his family, but an infectious, communicable disease produced by a germ which is universal, and that it is quite readily curable if taken in time. Inform them that the source of infection is the sputum cast off by the patient, and consequently, of the great responsibility which rests upon each individual to destroy the germs in the expectoration before they can become a source of danger to others. Secondly, a proper provision in the way of hospitals and sanaonce or twice during the night, has no vesical catarrh, or, just a trace of it, and if the residual urine does not exceed 60 c.c. = 2 ounces, I call this, with others, a cure.

12. Two cases need re-examination, having been operated upon in November and December, respectively, 1902.

13. *Bulletin of the Johns Hopkins Hospital*, 1902, Vol. XIII., page 36.

14. *Annals of Surgery*, July, 1902.

700 MADISON AVENUE.

THE RÖNTGEN AND FINSEN RAYS; ELECTROLYSIS; GALVANISM; FARADISM; HIGH-TENSION DISCHARGES, AND DIAGNOSTIC ILLUMINATION.

DESCRIPTION OF A PRACTICAL OFFICE OUTFIT FOR THE GENERAL SURGEON.

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THE author's outfit is suitable for use wherever the ordinary electric house-lighting is installed, and, in fact, can be carried from one house to another and connected with the current by simply removing one of the incandescent lamps and screwing in a plug instead. The weight of the apparatus, however, is such that it would take an express wagon to carry it, so that, except in very unusual cases, it is only for office use. In many small towns where there is no regular electric lighting system the current may be introduced into the doctor's office from the trolley system of street cars.

The first step in the installation of this outfit is the introduction of the current into the house. The electric company tears up the street, and brings three main wires into the cellar. These (one negative and two positive) are broken by a main switch having three arms, and when this is turned off the wires and apparatus in the house are entirely devoid of electricity. In the same fire-proof box with this switch the main wires are each interrupted by a fuse. This is a short piece of lead wire through which the current has to pass, and which will not transmit a current of more than twenty-five amperes or more than two hundred and twenty volts. The fuses are permanently in position, not turned off or on by the switch, and insure the apparatus in the house against excessive currents which might burn out a hundred dollars worth of wire in an instant; but in this way just burn out this fuse, costing a few cents, and stop right there. Of course you are cut off from the current until a new fuse is put in.

The current I use is the one hundred and ten volts, direct current, but the electrical manufacturers can construct the apparatus for use in connection with the one hundred and ten volts alternating current.

From the main-switch the wires pass through a meter, which in my case is the property of the New York Edison Company, and serves as the basis for their monthly bill for current used. Then the wires are interrupted again by three enclosed fuses which burn out with a current of ten amperes and two hundred and fifty volts. Beyond this the three wires are of very heavy copper, thoroughly insulated. Where they pass through floors they are enclosed in porcelain tubes, and where they pass through long spaces in walls they are enclosed in the spiral metal tubing called "flexible conduit." Wherever passing along the surface, they are enclosed in molding, and, of course, asbestos paint is used on this.

The "wiring" terminates in the doctor's office in two different lines, each of which is controlled by a switch of the capacity of ten amperes and two hundred and twenty volts.

Beyond this switch on each line is a regular electric-light socket, into which screws a plug at the end of the flexible insulated wires leading to the different pieces of apparatus.

The first to be described is the *x*-ray outfit. This consists of a liquid interrupter, a Ruhmkorff coil, a rheostat with pole-changer and an *x*-ray tube and stand.

The positive wire passes from one of the wall sockets to the interrupter. This consists of a large porcelain jar, partly filled with dilute sulphuric acid, in which is set a smaller jar with a pinhole orifice near the bottom, also containing dilute sulphuric acid. One conducting wire terminates in a leaden ring resting in the acid in the outer jar. The current passes through the liquid and the punctured jar to a leaden plate resting in the acid in the inner jar, from which it passes by a conducting wire to the rheostat and then through the primary coil and thence back through the negative wire to the wall-socket. The principle of this particular interrupter is that when the current begins to flow, bubbles of oxygen gas are liberated from the dilute acid by electrolysis and collect at the negative electrode and bubbles of oxygen gas form at the positive electrode. These are in sufficient amount to check almost completely the passage of the current, and the instant the current ceases the bubbles of gas rise to the surface and the current flows again with full force; and again bubbles of gas interrupt it.

These interruptions take place at the rate of about eight thousand per minute, and are for the same purpose as the little vibrator in the "home medical batteries"—that is, to cause a rapid succession of currents in the same direction through the primary coil, each of which produces by induction a current of vastly greater intensity or voltage in the secondary coil. When a mechanical interrupter or "buzzer," is used for an apparatus of this power, however, a separate electric motor is required of such a size as to shake the whole floor, and the sparks which fly about are of quite a terrifying nature. The absence of noise and jarring and danger from fire are the great advantages of a liquid interrupter, and then again it is more rapid. The author's gives all the way up to twelve thousand interruptions a minute. The care required to keep such a liquid interrupter in working order is simply to pour a glass or two of water into the outer and inner jars every few weeks, while with a mechanical interrupter one may frequently have to spend an hour in adjusting the vibrator.

The next part of the apparatus is the Ruhmkorff coil, and this consists of a primary coil of copper wire wound around a soft iron armature, and surrounded by a secondary coil made up of about a hundred thousand feet, about twenty-miles of insulated copper wire. This wire is one thirty-sixth of an inch in diameter and comes already wound with silk and is coated with melted paraffin as it is wound; disks of hard rubber separate it into several sections and lessen the probability of the coil burning out when the current is turned on full. The coil is the important part of the whole apparatus, and everything depends on the perfection and permanence of the insulation. The author had three different coils made by various makers before obtaining one that was satisfactory.

The secondary coil terminates in two poles about eleven inches apart. Each of these consists of a brass base about two inches high. A hard rubber section about two and a half inches high, and a brass top with a binding post. From the two bases project steel points with insulated handles, and these can be placed at any angle. When they are horizontal they come within an inch and a half of meeting in the middle, and when nearly vertical they transmit the current to the wires going to the *x*-ray tube, with or without a spark-gap, depending upon whether the points are in contact with the wires or not. In my own experience spark-gaps have proved essential to good *x*-ray work, and this, of course, is the object of having the posts broken by the hard rubber section instead of being continuously of metal. The sparks passing from the points to the wire are so powerful that the wire used to melt every once in a while, so I have permanently attached a short piece of heavy iron wire to each binding-post, and the conducting wires are simply hooked on to these. The sparks pass harmlessly from the points to the heavy iron wire. The connecting wires are spiral steel springs without insulation. These are infinitely more convenient than insulated copper wire, which, even if coiled into a spiral, requires the *x*-ray tube to be at just such a distance from the Ruhmkorff coil. With the springs the tube can be carried backward or forward and raised and lowered and turned about in every way without paying any attention to the wires. They take care of themselves.

The *x*-ray tube is a hollow sphere, about eighteen inches in circumference, with a cylindrical prolongation extending downward for about six inches. Through the sealed end of this passes the cathode, terminating in a concave mirror of aluminum just where the cylindrical part joins the spherical part of the tube. Above, there are two cylindrical projections, through one of which passes one anode, called the anticathode, terminating in a disk of aluminum just where the cylinder joins the sphere. The anticathode and the cathode are, so to speak, at opposite ends of the tube. The other anode enters the tube obliquely through a cylinder and terminates at the center of the spherical part of the tube in a disk or mirror of platinum. This mirror is at the exact focus of the concave mirror forming the cathode. The whole tube is hermetically sealed and contains a partial vacuum.

When in use, a direct current of very high voltage and very rapidly interrupted is driven from the cathode to the anodes through this partial vacuum, and the molecules of gas are projected from the concave cathodal mirror to the plane platinum anodal mirror, from which they are diffused in such a way that the whole hemisphere in front of the mirror is filled with a greenish light. This light is not the *x*-ray, but is present with it, and to the experienced eye is a perfect guide to the quality and intensity of the *x*-ray. The latter, of course, is invisible to the naked eye. If the hand be held up before the *x*-ray tube in operation, no special effect is noted. If you were in a dark room and the *x*-ray tube in operation were encased in cardboard, no light would be visible. But the invisible *x*-ray would penetrate the cardboard and would cause a bright green fluorescence in any surface coated with certain chemical substances, most commonly barium compounds. In such a darkened room you could hold your hand toward the place where the *x*-ray tube is known to be concealed, and hold a piece of cardboard, coated with such a chemical between your hand and your eyes, with the prepared surface toward you, and then you would notice a bright green fluorescence in the cardboard, shaded more or less by the rays having to pass through the bones and soft parts of the hand. It seems exactly as if you were looking at the bones and flesh through a more or less transparent medium, but what you really see is a shadow upon the fluorescent surface. A piece of cardboard prepared in such a way is called a fluoroscope, and if it is turned with the chemical surface away from the observer you see nothing at all. The idea is that the invisible *x*-rays will pass through almost any substance and excite fluorescence in certain chemicals. This fluorescence is ordinary light, and to see it you must have it exposed directly to view. For every-day use the fluoroscope forms the bottom of a dark box which can be applied to the eyes in such a way as to exclude all ordinary light. The chemical surface is toward the eyes, and when the apparatus is held up toward the *x*-ray tube the bottom is so brightly fluorescent as to seem transparent. Especially is this the case when some object like the hand is held between the *x*-ray tube and the fluoroscope.

The bones and all are so clearly seen that several times people have expressed surprise when they discovered later that they were not looking through a piece of glass, but through a heavy sheet of black cardboard. Using this apparatus, the room does not have to be darkened, though I think that slightly better results are obtained if it is dark. The *x*-ray appears to be interfered with to some extent by the presence of ordinary light waves. This fluoroscope is easily held in one hand, and with it we can at once see the condition of the bones and joints in any of the limbs, the condition of the ribs, clavicle, scapula, vertebræ, lungs, heart, liver and spleen. The fluoroscope hardly gives us a useful view of the pelvis or the hip-joint. The spleen and liver can be seen clearly enough, and abnormal size or lessened mobility during respiration are easy to demonstrate. The size, shape, and position of the heart are seen, and the density of the lungs is noted.

The *x*-ray tube is held in any required position by a stand consisting of a heavy iron base, with an iron upright, from which extends a wooden arm. The tube itself is provided with a separate prolongation by means of which the degree of vacuum is regulated. A tube which is "hard," *i. e.* in which the vacuum is very high and the gaseous contents are almost completely exhausted, as by overheating, shows greenish spots over the unlighted hemisphere, and the line between this hemisphere and the bright one is not sharply defined. A "hard" tube produces a light of great penetrating power, and is desirable for fluoroscopic examination through great thickness of tissue; but is not so desirable for fluoroscopic examination or photography of the bones of the hand or forearm. These bones look transparent and do not present the beautiful contrast which they do when examined with a "soft" tube.

Like every other scientific means of observation, a great deal more is seen by the practised eye than by one unaccustomed to this work, and especially is this the case here because a long study of the image is prohibited by the danger of an *x*-ray burn. Right here comes in the value of an *x*-ray photograph, which shows everything that can be seen with the fluoroscope and which can be studied and demonstrated as carefully and for as long a time as necessary.

The author is about to publish a description of a new process by which an *x*-ray photograph may be made and handed about the room in five minutes and fifteen seconds after the patient comes into his office.

Quite another portion of the outfit is a set of vacuum-electrodes for the high-tension discharge. Each of these is a vacuum-tube of a size and shape corresponding to the part to which it is to be applied. One has a flattened, bulbous extremity, and is applied to the surface of the body; and others are of special shapes for introduction into the bladder, rectum, vagina, nose, and ear. Such a tube is held by an insulated handle, and is connected with one pole of the Ruhmkorff coil, the rheostat being turned quite low. There is no connection with the other pole of the coil.

When the current is turned on, this tube becomes filled with waves of faint light, which apparently enter the body where the tube touches it. If the tube is held at a little distance from the body a shower of sparks passes from the tube to the body, and this is more or less disagreeable, according to the sensitiveness of the skin. This portion of the outfit is purely for therapeutic purposes, and the author has obtained extraordinary results in infantile paralysis, rheumatism, sciatica, lumbago, and especially in chronic colitis and impotence. For most purposes it is better to have the tube in contact with the surface, and then scarcely any sensation is perceptible and absolutely no disagreeable effects.

The portion of the outfit used for the production of the Finsen or ultraviolet ray consists of a Görl lamp as modified by Dr. Piffard, and described by him in a recent article, and a medium-sized Leyden jar. The whole being connected with the *x*-ray coil. The outer surface of the Leyden-jar is connected with one pole of the coil, and the inner surface with the other pole, no spark-gaps being used at either connection. The Leyden-jar acts as a condenser, and is absolutely necessary to the production of the ultraviolet ray. To the two poles of the coil are also attached the insulated wires leading to the Görl lamp. This connection with the coil is also without spark-gaps. The Görl lamp itself is easily handled, and consists of a hard rubber cylinder, at one end of which enter the insulated wires from the coil. These terminate in two brass knobs at the other end, between which are two others; the whole producing three spark-gaps. This end of the lamp is covered in by a lens of quartz-crystal which is transparent to the ultraviolet ray. When in use these sparks give out a noise like a package of firecrackers and the light has a faint, violet color

The presence of the ultraviolet ray in the light from this lamp is demonstrated by the beautiful green fluorescence produced in a piece of willemite, an ordinary looking rock, consisting of silicate of zinc. This fluorescence is prevented by the interposition of a piece of glass or of a piece of the thinnest tissue paper. And this is in very marked contrast to the *x*-ray, which will penetrate the thickest book. The ultraviolet ray is present in very small amount in sunlight, and its presence may be demonstrated beyond the violet end of the spectrum. Of course it is invisible. Originally it was obtained for curative purposes from sunlight by means of lenses concentrating all the rays and a layer of water or rock-salt to absorb the heat rays. Its production from electricity in various ways marks a very great advance.

Therapeutically the ultraviolet ray is limited to action upon the external surface of the body, and if it is to penetrate even the thickness of the skin, as in lupus, we must press the blood, which is opaque to these rays, out of the part, and this is one reason for having the quartz crystal covering the end of the lamp. This can be pressed firmly against the surface. Or, again, the part may be blanched by the application of adrenalin chloride. This will be absorbed all right by a raw surface or a mucous surface, but to blanch the unbroken skin we have to follow Dr. Piffard's suggestion and introduce the adrenalin chloride by electrolysis. The conditions which are benefited by it are especially lupus, and acne, eczema, epithelioma, and chronic ulceration.

One of the standard tables giving a variety of positions gynecological and otherwise, is a necessity for treatment by the *x*-ray and by the vacuum electrodes. Therapeutically the *x*-ray proper is invaluable in inoperable malignant disease and in acne, lupus, psoriasis, nævus, and colitis.

The final portion to be described is a portable switch-board connecting with the electric light service and containing rheostats and converters of various kinds, and a milliamperemeter. This gives all the varieties of galvanic and faradic electricity required for ordinary therapeusis and for electrolysis and for diagnostic illumination. This is contained in a box measuring about eight by eight by thirteen inches, and is connected with the wall socket by means of a flexible cord and plug. The various accessories, such as the urethroscope, sponge-electrodes and electrolytic needles require no description. This part of the apparatus can be taken to any house where there is electric light.

The cost of electric current for such an outfit is very small. Not more than five or ten cents an hour for *x*-ray and vacuum-tube work, and next to nothing for galvanic and faradic work. The apparatus is always in working order day and night, dry or damp weather, and has great advantages over a static machine in therapeutic uses.

103 West Seventy-sixth Street.

THE CHOICE OF METHOD FOR THE RELIEF OF RETROVERSION AND RETROFLEXION*

By JOHN VAN DOREN YOUNG, M.D.,
NEW YORK.

A MULTIPLICITY of methods in use for the relief of any condition of deformity or disease of the human body usually means that none of them is satisfactory, or that the principles governing the employment of the various useful procedures have not been understood clearly, and have given rise to a feeling of dissatisfaction on the part of the operator, and an effort to devise a new operation has been the result.

It is my feeling that the latter has been the case in dealing with retroversion, and retroflexion of the uterus. Each individual operator has employed some method, found it lacking, and becoming imbued with a belief in the great benefit of some other procedure, has gone to the extreme of thinking that because there was a retroversion or retroflexion, this method would relieve it, instead of recognizing that the condition was a complex one, and involved many structures, and any method of procedure must be in accord with the condition he sought to relieve.

My desire is to point out the factors that should govern us in choosing one of the recognized methods of treatment; and my deductions are founded on eleven years of clinical experience, during which I have had the opportunity to observe the results of treatment as applied by many gynecologists and general surgeons, long after they have lost sight of the cases, and on my own operative and non-operative cases and the literature on the subject.

I am free to say that my clinical experience has led me to be much more conservative as to the ultimate results in the relief of symptoms than one would think necessary when reading papers on new operations.

I shall not burden you with the report of many cases, or quotations at large, from a very voluminous literature, but will first ask your attention to the conditions found in a normal female pelvis:

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*Read before the New York Obstetrical Society.